VOLUME XXII NUMBER 2 WHOLE NUMBER 171

THE JOURNAL

OF

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

DEVOTED TO THE ADVANCEMENT OF ASTRONOMY AND ALLIED SCIENCES

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PUBLISHED MONTHLY
(*Ten numbers per year*)

February, 1928

PRINTED FOR THE SOCIETY
TORONTO: 198 COLLEGE ST.

FOREIGN AGENTS: WHELDON & WESLEY LTD.
2-4 ARTHUR STREET, NEW OXFORD STREET, LONDON, W.C.

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ROYAL ASTRONOMICAL SOCIETY OF CANADA

VOL. XXII, No. 2. FEBRUARY, 1928 WHOLE No. 171

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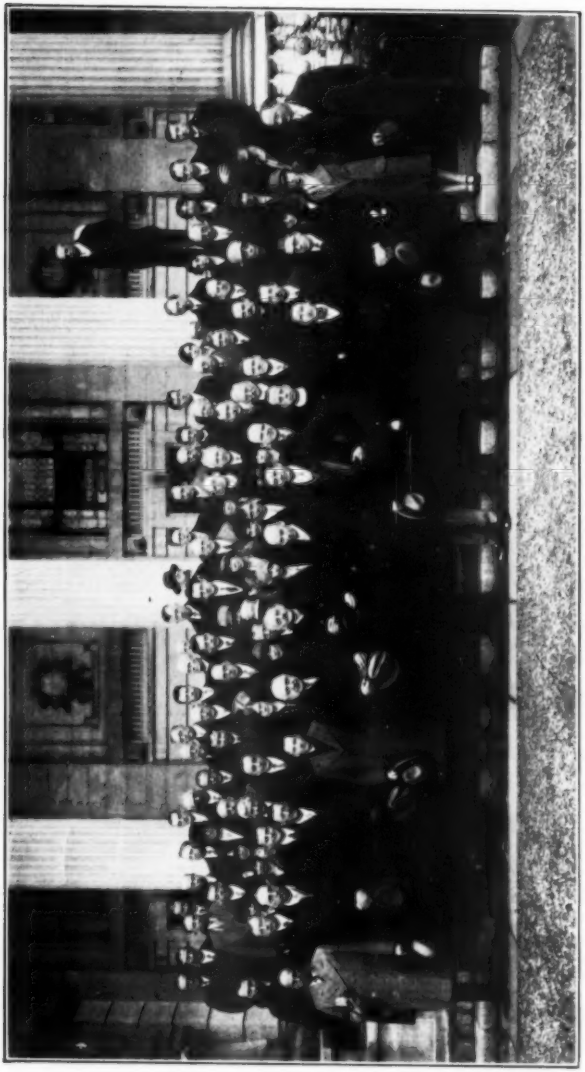
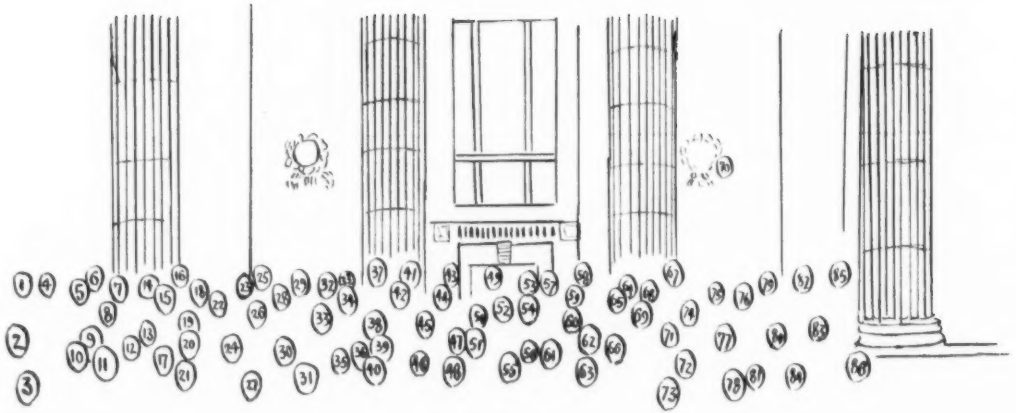
PLATE III



Thirty-ninth Meeting of the American Astronomical Society, at Yale University,
December 29 and 30, 1927.



KEY TO PLATE III.

1. Manson. 2. Waterfield. 3. Wilson, R. E. 4. Olivier. 5. Jordan, M. F. 6. Morgan 7. Paddock. 8. Woolard. 9. Miss Fairfield. 10. Straubel. 11. Stokley. 12. Miss Losh. 13. Miss Howarth. 14. Geromanos. 15. Miss Furness. 16. Andrews, L. B. 17. Putnam. 18. Curtis. 19. Pickering. 20. Campbell, Leon. 21. Slocum. 22. Stearns, C. L. 23. Hall. 24. Lundin. 25. Eichelberger. 26. Arnold. 27. McLaughlin. 28. Littell. 29. Schilt. 30. Miss Hill. 31. Schlesinger. 32. Hendrick. 32*. Bailey. 33. Currier. 34. Slavenas. 35. Miss Williams. 36. Boothroyd. 37. Turner. 38. Miss Swartz. 39. Miss Barney. 40. Brown. 41. Yalden. 42. Brouwer, Dirk. 43. Luyten. 44. Marriott. 45. Miss Bigelow. 46. Miss Lange. 47. Miss Sawyer. 48. Dugan. 49. Green. 50. Miss Cannon. 51. Maxwell, A. D. 52. DeLury. 53. Rogers, Chas. E. 54. Robertson. 55. Fox. 56. Miss Hawes. 57. Phillips. 58. van de Kamp. 59. Peters. 60. Gerasimovic. 61. Crump. 62. King. 63. Rodes. 64. Miss Clough. 65. Miller. 66. Duncan. 67. Stewart. 68. Daghlian. 69. Mitchell. 70. Pawling. 71. Vyssotsky. 72. Stetson. 73. Hujer. 74. Boss. 75. Miss Lewis. 76. Russell. 77. Miss Young. 78. Eckert. 79. Miss Harwood. 80. Miss Ames. 81. Mrs. Fecker. 82. Shapley. 83. Miss Payne. 84. Miss Wills. 85. Kovalenko. 86. Fecker.

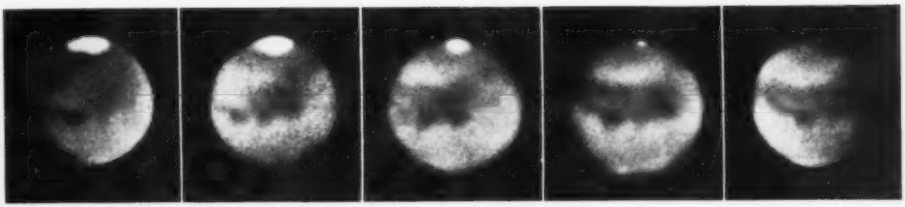
Journal of the Royal Astronomical Society of Canada, 1928.

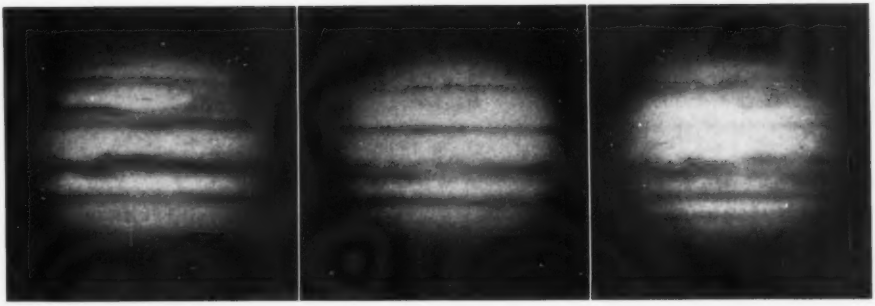
Mar
date

PLATE V

Martian dates.

May 11 | May 29 | June 23 | July 31 | Aug. 20





1917 | 1926 | 1927

Above: MARS. Actual photographs of the planet Mars taken through a large telescope, showing successive stages in the gradual decrease of the snow at the pole and the darkening of the planet's tropics with the advance of the Martian summer. This gradual darkening of certain regions of the planet in its summer season and their subsequent fading in winter seems best explained by assuming that these dark areas are due to vegetation. The dates given with the photographs are seasonal dates on Mars which correspond to our calendar dates.

Below: JUPITER. Photographs showing the region about the Great Red Spot (visible above centre of disc) displaying changes on its surface, especially the disappearance of the dark south tropical belt.

Photographs by E. C. Slipher, Lowell Observatory

PLATE VI

Above: COMET 1927K, SKJELLERUP. This photograph was taken at mid-afternoon, Dec. 16, 1927, when the comet was only five degrees from the Sun, using a red filter and red-sensitive plate with a six-inch telescope, exposing about two seconds. These circumstances evidence the great brilliancy of the comet on this date.

Below: SPECTRUM OF SKJELLERUP'S COMET, photographed at mid-day Dec. 19, 1927. The day sky spectrum appears as a weak background. The short bright lines are of the iron and sodium comparison spark. The only evident features of the comet's spectrum are the two bright D lines of sodium. Their large shift shows that the comet was receding at a rate of 60 miles per second. These lines, while very unequal in the comparison spark, are about equally strong in the comet.

Photographs taken at the Lowell Observatory.

THE JOURNAL
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OF CANADA

Vol. XXII, No. 2 FEBRUARY, 1928 Whole No. 171

THE THIRTY-NINTH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY

(With Four Plates)

By Ralph E. DeLury

The American Astronomical Society held its thirty-ninth meeting at Yale University, New Haven, on Thursday and Friday, December 29 and 30, 1927. There was an exceptionally large number present for a winter meeting,—nearly one hundred, not all shown in the accompanying plate,—some having hastened from the Nashville meetings of the A.A.A.S. to attend. The weather was so mild that those from a distance, who had left snow behind, had some of the feelings of attending a summer meeting.

Many of the visitors found quarters in nearby hotels, while a good many availed themselves of the opportunity of staying in White Hall, a convenient and comfortable dormitory, vacant during the holidays.

Headquarters were at the Faculty Club where luncheon and dinner was served, and where, after the sessions of the day, acquaintances were renewed and problems discussed, in the genial atmosphere of "Come stir the fire and make the shutters fast, . . . So let us welcome peaceful evening in", amid comforts none the less appreciated though "Winter, ruler of the inverted year" ruled not too harshly without.

The meetings were held in the William L. Harkness Hall, in a room comfortably well filled. By adhering closely to the allotted times for presentation of the individual papers, President Comstock and Past-President Schlesinger, while allowing liberal time for dis-

cussion, managed to have the program of nearly fifty papers run through in the four sessions. This was greatly facilitated by Secretary Dugan's careful arrangement of the program which brought like subjects together. The following papers, rearranged in convenient groups, were on the list:

Sun and Solar System.—C. P. Olivier, Fireball of February 27, 1927. Peter van de Kamp, A Photographic Determination of the Diameter of Mars. S. A. Mitchell, The Total Eclipse of 1927. R. L. Waterfield, Lantern-Slides of Corona of June 29, 1927. H. T. Stetson and L. B. Andrews, On the Distribution of Light in the Solar Corona of 1926. W. J. Luyten, The Total Eclipse of the Sun at Jokkmokk. Caroline E. Furness, The Eclipse of August, 1932. L. J. Comrie, The Track of the Total Solar Eclipse of 1932, August 31. Ross W. Marriott and John A. Miller, A Determination of the Diameter of the Moon from Eclipse Photographs. E. W. Brown, Results of Observations of the Moon in 1926. F. B. Littell and J. C. Hammond, Some Results of the World Longitude Work in 1926. C. O. Lampland, Recent Radiometric Observations of the Planets. E. C. Slipher, Recent Photographs of the Planets. E. C. Slipher, Daylight Observations of Comet Skjellerup. C. O. Lampland, Radiometric Observations of Skjellerup's Comet. James Stokley, An Attempt to Observe Skjellerup's Comet from an Airplane. H. R. Morgan, Clock-rates and Rotation of the Earth. Ralph E. DeLury, Sunspots and Animals.

Binaries, Orbits and Variables.—Paul Slavenas, The Distribution of the Periastra of Spectroscopic Binaries. R. N. Van Arnam and S. L. Boothroyd, A Spectroscopic Investigation of β Cephei. R. W. Sitterly, The Eclipsing System, RS Canum Venaticorum. J. A. Pearce, The Orbits of the Spectroscopic Components of the B-Type Star HD 176853. F. Henroteau, The Brighter Super-Giant Stars. R. F. Sanford, Note on the Eclipsing Variable RX Herculis. Alexander Vyssotsky, Note on the Double-Stars, E259 and E1030.

Spectra and Spectral Classification.—Harlow Shapley, Spectral Classification and the Henry Draper Extension. Cecilia H. Payne, The Spectra of Luminous Stars. Emma T. R. Williams, Photometry of Balmer Lines in A Stars. Frank S. Hogg, Spectrophotometry of Class M Stars. B. P. Gerasimovic, On the Stars Whose

Spectra Have Bright Lines. Annie J. Cannon, Variation in Spectral Class of Long-Period Variables. Margaret L. Walton and Harlow Shapley, Variation in Spectral Class of Cepheid Variables. H. N. Russell, W. S. Adams and Charlotte E. Moore, A Physical Calibration of Rowland's Solar Spectrum Intensities. W. S. Adams and H. N. Russell, A New Method of Determining Temperatures and Pressures in Stellar Atmospheres. J. Q. Stewart, A Theory of the Production of Lines in Stellar Spectra. Charles Hujer, On Silicon and Strontium Stars in Class A of Harvard Classification. C. C. Kiess, Standard Wave-Lengths in the Vaccum Arc Spectrum of Titanium. C. T. Elvey, A Note on the Origin of the Nebular Spectrum.

Star Magnitudes, Positions and Motions.—Frederick Slocum and C. L. Stearns, The Effect of Atmospheric Dispersion in Stellar Parallax Determinations. E. C. Phillips, Second Note on Personal Equation in Observing Occultations. J. A. Pearce and S. N. Hill, Graphs for Obtaining the Position Angle and Distance of the Apex, and the Galactic Co-ordinates for Any Star. H. R. Morgan and U. S. Lyons, Magnitudes from Transit Circle Observations. W. J. Luyten, Some Results Obtained With the Blink-Microscope.

Clusters.—Jan Schilt, The Distribution of Light in the Central Part of the Globular Cluster, Omega Centauri. Alexander Vyssotsyk, Some Results of a Photometric Study of the Double Cluster in Perseus.

Instruments and Methods.—Photometry at the Amherst College Observatory. James Stokley, The Optical Planetarium.

The publication of the above papers will add much of value to astronomical literature. It is understood that Comrie's paper on the eclipse of 1932 will appear in this JOURNAL. Readers will also be interested in Slavenas' paper on the distribution of periastra of spectroscopic binaries which brings up-to-date a subject discussed by the late Miller Barr in this JOURNAL twenty years ago. Abstracts of all papers will appear as usual in Popular Astronomy commencing in March. Thanks are due to Dr. V. M. Slipher for permission to reproduce Skjellerup's comet secured at Lowell Observatory. It is a real record to photograph even a part of a comet's tail in daylight at a distance 5 degrees from the sun. (See Plates V, VI.)

Before the Friday morning session a large number of the

visitors, escorted by a guide well-versed in Yale traditions, had an opportunity of inspecting various interesting places about the University,—Battell Chapel, Harkness Memorial Tower, Memorial Quadrangle, The University Theatre, and others. Many things were done to make the visit of the delegates a very pleasant one, and the Society's deep appreciation of the splendid hospitality extended to them was expressed in a Resolution enthusiastically passed.

President Comstock, who was asked at the Madison meeting to name a Committee to submit a form of incorporation of the Society, gave an account of the work of this Committee consisting of Jewell, Stebbins and himself. He introduced a Resolution, which was passed, that incorporation of the Society in the State of Illinois be brought about in accordance with the form submitted by the Committee, and the location to be "at the Yerkes Observatory, adjacent to the village of Williams Bay in the county of Walworth in the State of Wisconsin" where the records of the Society are kept.

Secretary Dugan introduced a Resolution which was heartily passed, expressing to Joel Stebbins the Society's great appreciation of his faithful and excellent services as Secretary rendered to the Society for so many years.

On Saturday morning following the meetings of the Society, the American Section, International Astronomical Union, held a meeting, Dr. Harlow Shapley, Chairman of the Executive Committee in the Chair. Thirty members of the technical committees were present. Several resolutions were introduced, and reports presented for most of the seventeen committees. Some of the subjects discussed were: the standard unit of stellar distance; an international code for telegrams; the increase in accuracy of new secondary standard wave-lengths of iron lines, and the new system of solar standards; nomenclature of variable stars; plans for co-operation in observation and classification of nebulae; mathematical definition of the limits of the northern constellations; and the extension of radial velocity determinations to fainter stars. Any astronomer in the United States may be recommended as a delegate of the Section to the Meetings of the Union in Leiden next July.

Dominion Observatory,
Ottawa, Canada.

AN INTERESTING STAR

By William H. Christie

The following summary of the work that has been done on 12 Lacertae, an interesting member of the β Canis Majoris type of stars, is written for the Journal in popular, rather than technical language, in the hope that it may be of interest to the many members of the R.A.S.C. who are not professional astronomers but who have a lively interest in the science.

As the subject of this article has, I believe, been investigated more fully than any other member of this group of stars, it serves as an excellent example of one of the most interesting, and at the same time the most perplexing, objects submitted to spectroscopic analysis.

The β Canis Majoris class of stars—so called because that star is the best known member—are spectroscopic binaries of extremely short period; periods of but a few hours. The name spectroscopic binary is given to a star which varies in its velocity as measured by the spectroscope, *as though* there were two bodies revolving about their common centre of gravity, alternately receding from and approaching us.

The variation in the velocity of 12 Lacertae was first detected by Adams at the Mount Wilson Observatory in 1912, where it was included in a radial velocity programme then being carried out with the 60-inch reflector.[1] A few spectrograms were obtained which, when measured, revealed the binary character of the star. Later, at Ottawa, Young selected this star for observation in order to determine the elements of its orbit. A large number of spectrograms were obtained but the investigator was unable to fix the period until several plates were taken in succession on the same night; these at once showed the nature of the period, which turned out to be 0.193089 days, or about 4 hours and 38 minutes. On

fitting the older observations to this period, however, there were large discrepancies, though there was no reason to believe that the period was incorrect, and Young at once suspected the true state of affairs—the amplitude, or the extreme range of the observed velocities, varied from cycle to cycle. The results of his preliminary investigation were published,[2] and in this publication he remarks that it would be interesting to investigate the star with a larger instrument, one capable of obtaining a larger number of spectra in a single cycle.

On the completion of the 72-inch reflector at Victoria, British Columbia, Young now had the opportunity of carrying on the investigation further, for the great light-gathering power of the telescope permitted him to obtain spectra in five minutes, whereas with the 15-inch refractor at Ottawa an exposure of about one hour was required. Thus, instead of obtaining but four or five spectra per cycle, the observer was able to obtain, under good conditions, as many as forty or fifty if he so desired. Young's suspicions were confirmed as soon as these new plates were measured and reduced; and in addition he discovered that the widths and the character of the spectral lines were also variable, as he had already suspected. The results of this second investigation were among the first fruits of the largest telescope in existence at that time.[3]

Each year, following this second paper, Young obtained a series of plates of this star until he left the observatory staff in 1924. On leaving he very kindly handed over to the writer two complete unmeasured series of spectra for measurement and discussion and with them the suggestion of carrying on the work on this star during the summer vacations which the writer spent as observing assistant at the observatory.

We now turn to another phase of the work. At the University of Illinois Stebbins was working on variable stars with the photo-electric cell—an instrument capable of detecting extremely small changes in the light of the stars. On his observing programme he had included a number of spectroscopic binaries, in the hope of discovering some eclipsing variables among them, for if the earth happened to lie in or near their orbital plane a variation of their light would occur when the light of one star was cut off by the other passing in front of it. 12 Lacertae was included on this programme,

and in 1916 Stebbins announced at a meeting of the American Astronomical Society that the light of this star was variable.[4]

Guthnick, in Germany, also investigated this star with the photoelectric cell and published his results, which included several interesting curves of the observed magnitudes of this variable.[5] This work revealed that the light varied in a period apparently identical with that of Young's period for the velocity change; moreover the amplitude of the light curve varied from cycle to cycle, from one that was almost masked by the errors of observation (which were remarkably small) to one of nearly 0.2 magnitude.

Up to the time that the writer took over Young's work no single series of observations had covered much more than one complete cycle, so in order to gain some information as to the character of the amplitude change it was decided that it would be worth while to observe the star for as long as possible on a single night. On September 9, 1924, the telescope was set on the star as soon as it was dark enough to commence observing and the star was followed throughout the night. When the coming of the day stopped the work seventy-six spectra, covering slightly more than two complete cycles, had been obtained. All these spectra were well exposed and the slit of the spectrograph had been made twenty-five per cent. narrower than usual in order that the plates might be of the best quality. This procedure slightly lengthened the exposure time, the average being about 7½ minutes.

The velocities obtained from these plates indicate that the change in amplitude is fairly rapid, as the reader may see for himself on examining the velocity curve obtained that night which is reproduced here. The early cycle, with an amplitude of 30 km., is immediately followed by one with very little change in velocity. Of the reality of this sudden change in amplitude there can be no reasonable doubt; moreover, it is confirmed by the run of plates obtained on September 3, 1925 (Fig. 1).

Dr. Young has stated that all the previous observations agreed with a period of 0.1930890 days and those of 1918 also fitted into the same period. From some of the 1923 and 1924 velocity curves it appeared as if a shorter period would be more suitable, and a period of 0.18235 days was found which fitted the 1923 and 1924 observations, but when carried back to 1922 and earlier it would

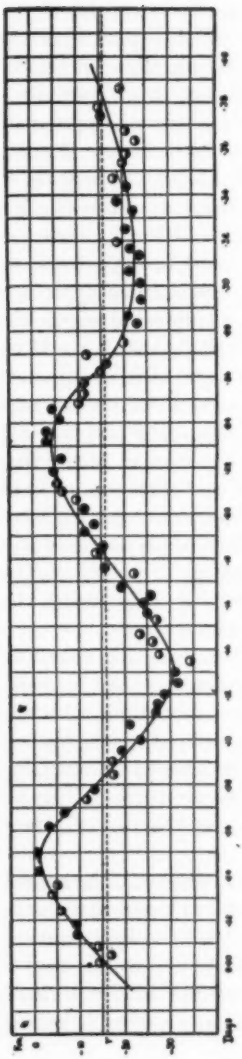

Fig. 1.—September 9-10, 1924.

not suit, whereas Young's period suited all the observations within the limits of the accuracy with which the phase was determined. This was discussed in the writer's first paper.[6]

The following year an attempt was made to determine the period of the amplitude change by obtaining spectra at the computed times of the points of maximum velocity of approach and recession. The results were not very satisfactory, owing to the small amount of observational information obtained, but a period of 0.89 days was found which may possibly be the one sought.

Following the work of Guthnick and Stebbins the writer, after discussing the matter with the director, decided to try to correlate the velocity and light curves of this star by determining the magnitude of the variable simultaneously with the velocity curves. The original intention was to use a selenium cell and a cell and galvanometer were accordingly borrowed from the Department of Physics of the University of British Columbia. Preliminary work showed the difficulties of this method and it was decided to substitute the method of extra-focal image photometry.

This method consists in photographing the star field with the plate out of focus so that the star images, instead of appearing as

tiny dots on the plate, are planet-like discs. These enlarged star images are readily measured on the microphotometer, an instrument for determining the density of the image on the photographic plate; hence, as the density is proportional to the brightness of the star, the latter quantity is readily obtainable.

As the Observatory did not possess a lens suitable for this work one was borrowed from a local photographic supply house. This was an old Ross lens of 1½-in. aperture and 24-inch focal length. A long wooden box of square cross section was constructed and fitted to take the lens-mount and the 4-in.×4-in. plate-holders used in direct photography with the telescope. This makeshift camera was attached to the tube of the 72-inch telescope by means of a wooden bracket which fitted into the vacant mounting rings of one of the four-inch finders, the camera being supported far enough from the tube to prevent its upper end from obstructing the field of the lens embraced by the plate.

A number of photographs were taken, both inside and outside the focus, with this camera while the regular observing programme was being carried on; from these the position that gave the most suitable images was determined. These images were none too good at the best, but at one position a usable image about 0.6 mm. in diameter was obtained. In order to determine what part of the characteristic curve of the seed 30 plates used would be most suitable for the work in hand an exposure was made on the Pleiades. Measures of this plate showed that an exposure of the order of twenty minutes on a fifth magnitude star would give images of moderate density lying on the straight part of the characteristic curve.

For comparison there are two stars, 8 and 10 Lacertae, each separated by about a degree from 12 Lacertae, and of magnitudes 5.38 and 4.91, respectively, as compared with the average magnitude of the variable of 5.3. The images of these stars on the plates are about one centimetre from that of the variable, thus both the distances and the magnitudes of these stars are admirably suited for the accurate determination of the magnitude of the variable.

The density of the star images was measured on the microphotometer of the Observatory, both star and comparison wedge being thrown well out of focus; this serves to make the images

more uniform in appearance. To overcome any personal bias that existed when matching star-image and wedge, the plates were each measured four times, the plate being turned through ninety degrees between succeeding sets of measures. Had the images been of uniform density such a procedure would, of course, have been superfluous, but that this extra work was justified is apparent from the run of the single sets of measures as compared with the mean of the four.

The corrections due to the distance of the images from the centre of the plate were determined by making a series of equal exposures, across a plate, of a bright star near the meridian and by plotting these densities against the distance from the centre of the plate. These corrections were found to be negligible, while an attempt to introduce corrections for plate fog made clear that the error thereby produced was probably larger than that to be eliminated. The magnitude of the variable was found by direct interpolation, except in a few cases where it was fainter than the faintest comparison star, when extrapolation was used. The magnitudes of the two comparison stars are taken from the Revised Harvard Photometry.

As has been already mentioned, the widths of the spectral lines of this star are also variable. Measures were made of this variation in the three series of spectrograms that were obtained concurrently with the direct photographs. These measures reveal a surprising irregularity which appears to be real, and repeated measures tend to confirm this suspicion. This variation is shown by the broken lines in the accompanying curves (Fig. 2), which are offered tentatively and not without hesitation. There are several factors—exposure, development, the personal equation in deciding upon the position of the boundary of a broad, somewhat diffuse, line—that makes it extremely difficult to measure a variation in line-width with a micrometer. However, it is perhaps best to give the results obtained rather than to let them pass with a mere mention or neglecting them altogether. The widths of the eight principal lines,

three due to hydrogen, $H\beta$, $H\gamma$, $H\delta$, and five to helium, 4471, 4388, 4144, 4026 and 4009, form the basis of these measures.

The individual observations of the writer are omitted in this discussion but will be found in the papers[5, 6] referred to at the end of this article, the last of which is now in press. It will be of interest, however, to include the information regarding the observed

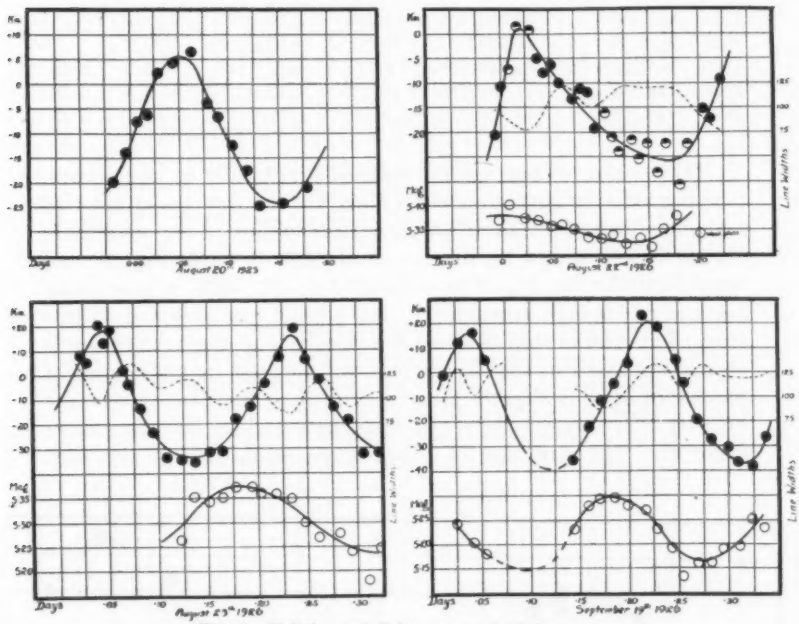

Fig. 2.—Velocity and light curves of 12 Lacertae.

cycles illustrated by the velocity curves. For the information of those readers who are not familiar with the notation used it might be said that the third column, headed "K" gives the half value of the range of the velocity curve; the fourth, headed γ, contains the velocity of the system as determined from the velocity curves; the fifth Vo (Ca), contains the velocity as determined from the calcium lines.

DATA OF OBSERVED CYCLES

Date	Julian Day	K	*r*	Vo (ca)	Mag.
1922—Nov. 22....	2,423,381.550	22.5	−11 km.	−14.8	
1923—Sept. 17....	3,680.667	16.0	−13 "	−14.7	
1924—July 28....	3,995.780	22.5	−14 "	−11.9	
1924—July 31....	3,998.883	36.0	−14 "		
1924—Sept. 9....	4,038.636	15.0	−16 "	−12.7	
		5.0			
1925—Aug. 20....	4,382.757	15.0	−10.0 "	−13.6	
1925—Sept. 3....	4,396.651	25.0	−15.0 "	−12.7	
1926—Aug. 22....	4,749.798	13.5	−16.5 "	−15.2	5.35
1926—Aug. 25....	4,752.696	26.5	−15.0 "	− 9.8	5.30
1926—Sept. 19....	4,776.615	31.0	−14.0 "	−15.1	5.22

These observations are represented graphically in the accompanying velocity curves and well illustrate the changes in velocity and magnitude of this peculiar star. The rapidity of the amplitude change is well shown by the curves of Sept. 9, 1924 (Fig. 1), and Sept. 3, 1925 (Fig. 3). The curve of Aug. 22, 1926, is interesting because of its high eccentricity, the highest yet obtained in this star. The relationship between the velocity and the light curves is clearly indicated in Fig. 2, where it will be seen that the point of maximum light is slightly later in time than the place where the velocity curve crosses the γ axis with the velocities becoming more negative. The variation of the average magnitude of the star,

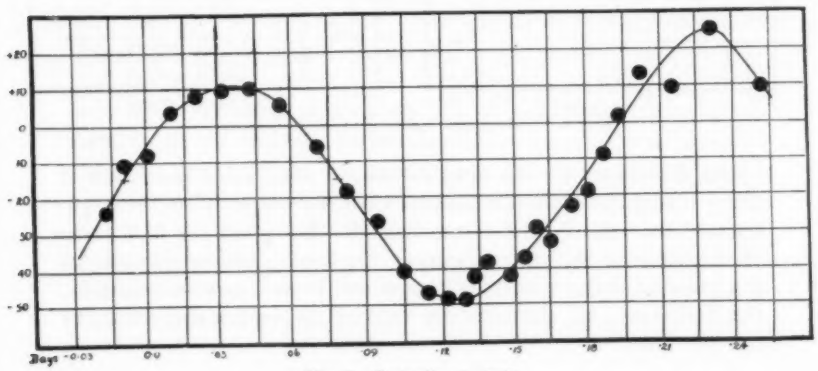

Fig. 3.—September 3, 1925.

discovered by Motherwell,[9] is also clearly shown. This, however, may be due to the variation of the light of one of the comparison stars, 8 Lacertae, which, from Guthnick's work, seems to have a

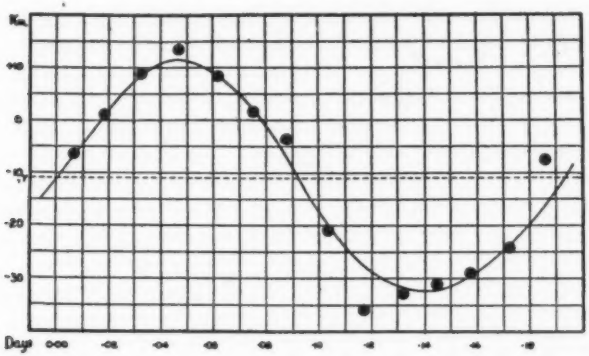

Fig. 4.—November 22, 1922.

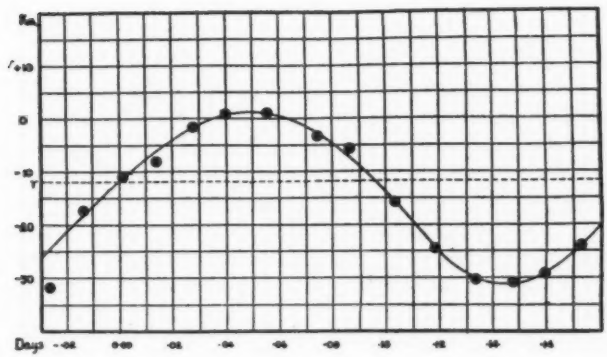

Fig. 5.—September 17, 1923.

slight variability, although it is hardly thought that this would affect the measures to such a large extent; the probable range of 8 Lacertae is 0.05 mag. at the most. The half-filled circles in the accompanying curve (Fig. 6) indicate that the plates from

which those velocities have been obtained have been measured two or more times and the mean of these measures adopted.

In seeking an explanation of stars of this type there are several

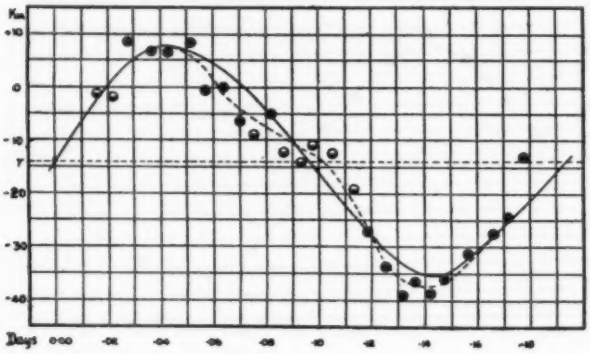

Fig. 6.—July 28, 1924.

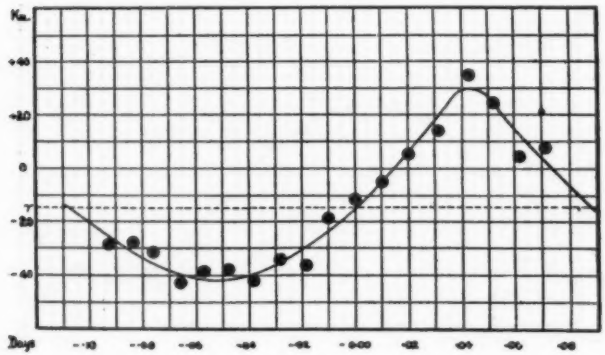

Fig. 7.—July 31, 1924.

variations revealed by the observations that must be satisfactorily accounted for. There are six conditions that must be fulfilled. The hypothesis must explain:

(1) The apparent variable velocity of the star.

(2) The variation in the amplitude of the velocity curves.

(3) The variation in the eccentricity and form of the velocity curves.

(4) The variation in the value of γ.

(5) Secondary humps in the velocity curve.

(6) The variation in the light of the star and the amplitude of the light curves.

It will be of interest to attempt to explain the observed variations from the data now available.

It is at once evident that we are not dealing with a simple binary system, because of the small value of the semi-major axis of the ellipse in which a true binary star would move; so although the writer has used terms that belong to true orbital elements, they have been used for convenience and not with the idea of describing orbital motion. We must assume that we have either a complex system or a single pulsating body. The latter hypothesis, variations of which have been proposed by several astronomers, seems to be the most promising. The variation in amplitude precludes the possibility of a simple pulsating spheroid, but if we consider an ellipsoid both pulsating and rotating this explanation of the observed variations appears more hopeful.

Jeans,[8] in his theory of Cepheid variation, considers a somewhat similar body for he states, "It is well known that a mass of rotating matter, which has not got too great a central condensation of mass, becomes secularly unstable as soon as it passes a certain clearly defined point on the Jacobian series of ellipsoids. The oscillation through which instability first sets in is one in which the surface undergoes a third harmonic deformation. The star begins by being pear-shaped, the extent of the divergence from the ellipsoid shape being oscillatory in amount but showing a general tendency to increase."

Let us assume that 12 Lacertae is such a body as Jeans has postulated, which is pulsating in a period of 0.193 days, the greatest amplitude of the pulsation being in the direction of the pear-shaped protuberance or along the major axis. If this body had no rotational motion, the observed velocity curve would be constant in amplitude and form, but as the primary cause of the instability is rapid rotation about the minor axis, it is evident we must con-

sider the effects of such a rotation. This rotation, which is assumed to have a longer period than the pulsation, changes the orientation of the protuberance and will evidently modify the form of the velocity curve, the amplitude being a maximum when the protuberance is most nearly in the line of sight. Further, the change in shape of the curve produced by the varying orientation is likely to broaden one of the nodes, hence causing an apparent shift of the γ axis. It hence seems possible to explain the variation in amplitude and form of the velocity curves by the rotation of such a pu sating body, while the change in magnitude of the star itself may be explained by the variation in the luminous area presented to the observer and to the probability that different parts of the pear-shaped body may be of varying brightness.

In conclusion the writer must mention a variation in the relative intensities of the two lines 4471 and 4481. The magnesium line 4481 is seen to vary from a strength of 2, on a scale of 10, to one barely visible, and as this same variation has been seen in stars with a variable velocity whose periods have not been obtainable it is suspected that this may be a feature of this type of star.

Victoria, B.C.,
January, 1928.

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(1) Astrophysical Journal, XXXV, p. 163.
(2) Publications Dom. Obs., III, No. 3.
(3) " D.A.O., I, No. 2.
(4) Popular Astronomy, XXV, p. 657.
(5) Astronomische Nachrichten 4583 and Jubiläumsnummer.
(6) Publications D.A.O., III, No. 9.
(7) " " IV, No. 6.
(8) Monthly Notices, R.A.S., LXXXV, p. 797.
(9) Communicated to the writer in conversation at Ottawa.

THE D.A.O. ASTROPHYSICAL CLUB

During the past year the scientific staff of the Observatory have met weekly in the library on Friday afternoons for the discussion of astrophysical problems. The papers presented have been of considerable importance, and have covered the whole field of astrophysics, from atomic theory to the spiral nebulae. The majority have dealt with the physical properties of the stars, such as, their mass, density, temperature, etc., and the general stellar problems of the distances, distribution and motions of the stars.

The papers were followed by interesting and critical discussions in which all members participated. The problems presented called forth many solutions, some ingenious and some otherwise. Many new theories came into being, flourished, and died, during the lifetime of a cup of tea and a piece of cake.

In addition to the regular papers, our local problems were discussed, and helpful criticism exchanged. The weekly meetings have kept the members in touch with the various programmes in progress, here and elsewhere, but have also materially assisted in maintaining the harmonious spirit of the institution.

Since its organization on January 4, 1927, (J.D. 2424885.4791) fifty-two consecutive meetings have been held. Every talk has been interesting, and every member has enjoyed the association together. At the last one, on December 30, at which the Director presided, the club fittingly celebrated its first birthday.

The papers presented by the various speakers were as follows:

1. *Papers by Dr. J. S. Plaskett—*

Jan. 14.—Three Peculiar Spectra—υ Sag., H.D. 50820, H.D. 45910, (D.A.A. Vol. 4, No. 1).

Feb. 11.—On Corrections to Proper Motions.

Mar. 11.—Extra-Galactic Nebulae. (*Hubble*).

Apr. 15.—On the Masses of the Stars. (*Gerasimovic*).

May. 12.—Parallaxes of the Helium Stars. (*Kapteyn*).

June 17.—The Period-Luminosity Law of Cepheid Variables. (*Leavitt and Shapley*).

Aug. 5.—The Rotation of the Galaxy. (*Lindblad and Oort*).

Sept. 16.—The Stationary H and K lines of Calcium and Sodium.
Oct. 28.—The Rotation of the Galaxy as determined from observations of the Class B Stars at Victoria.
Nov. 25.—Researches on the Distribution of the Absolute Magnitudes of the Stars. (*Malmquist*).
Dec. 30.—The Masses and Luminosities of the Eclipsing Variables. (*McLaughlin*).

2. *Papers by W. E. Harper—*

Jan. 21.—Variations in the Orbital Elements of Boss 3511.
Feb. 18.—Correlation between Radial Velocity and Spectral Class (Review of literature).
Mar. 18—The Relation of Hydrogen Line-widths to Absolute Magnitude for Class A Stars (*Fairfield*).
Apr. 22.—The Spectra of the Visual Double Stars. (*Leonard*).
May 27.—The Spectra of the Cepheid Variables. (Review of literature).
July 27.—Distribution of the Stars according to Spectral Type. (Review of literature).
Sept. 23.—Methods of Determining the Absolute Magnitudes of the B- and A-type Stars—First paper.
Oct. 21.—Methods of Determining the Absolute Magnitudes of the B- and A-type Stars—Second paper.
Dec. 2.—Determinations of the Absolute Magnitudes of the A-type Stars at Victoria.

3. *Papers by H. H. Plaskett—*

Jan. 28.—Theoretical Interpretation of Spectroscopic Absolute Magnitude.
Feb. 25.—The Planetary Nebulae.
Apr. 1.—A Photographic Study of the Flash Spectrum (*Carpenter*).
Apr. 29.—*Milne's* Model of Stellar Chromaspheres.
June 2.—Review of *Eddington's* Monograph—"The Internal Constitution of the Stars."
July 15.—Diffuse Matter in Interstellar Space, (*Eddington*).
Sept. 2.—The Spectrum of Z Andromedae.
Sept 30.—Absorption Line Intensities in Astrophysical Spectra. (Review of literature).
Nov. 4.—Intensity Distribution in Spectral Lines (*Ormstein* and *Minnaert*).
Dec. 9.—*Unsöld's* Chromospheric Theory.

4. *Papers by J. A. Pearce—*

Feb. 4.—The Cepheid Problem (Review of literature).
Mar. 4.—The Solar Motion as determined from Proper Motions. (Review of literature prior to 1900).
Apr. 8.—The Reflection Effect in Eclipsing Variables (*Eddington*).
May 6.—The Dwarf Comparison to Castor. (*Van Gent, Joy* and *Sanford*).
June. 10.—The Solar Motion as determined from Proper Motions. (Review of literature since 1900).
July 8.—The Solar Motion as determined from Radial Velocities. (Review of literature).

Aug. 26.—Introduction to Stellar Statistics. (*Charlier*).
Oct. 7.—The Determinations of Colour Indices. (*Seares*).
Nov. 11.—The Distribution of the Class B Stars. (*Shapley* and *Charlier*).
Dec. 16.—Corrections to the *Preliminary General Catalogue*. (*Raymond Boss* and *Jenkins*).

5. *Papers by Dr. C. S. Beals—*

Oct. 14.—The Imperial College, London—Account of College, Staff, Equipment and Work in Progress.
Nov. 18.—Excitation of Spectra—Discussion on the Laboratory Methods.
Dec. 23.—Zeeman Effects and Multiplet Structure. (*Back* and *Landé*).

6. *Papers by occasional speakers—*

Dr. H. Zanstra, Professor of Astronomy, University of Washington.
Mar. 25.—On the Luminosity of Comets.
July 22.—On the Width of Spectral Lines.
Sept. 9.—Elementary Principles of Celestial Mechanics.

A. E. Johns, M.A., Professor of Mathematics, Brandon College.
Jan. 4.—China:—Its Educational, Social and Political Problems.

R. M. Petrie, University of British Columbia.
May 20.—Measurement of the Velocity of Light. (*Michelson*).
June 24.—The 1924 Opposition of Mars—Résumé of Observations at Mt. Wilson, Lick and Flagstaff Observatories.
Aug. 12.—Measurements of Planetary Radiation. (*Coblentz* and *Lampland*).

P. M. Millman, University of Toronto—
June 29.—Japan, the Modernization of the Old Empire.
Aug. 19.—Statistics of Short Period Binary Stars.

NOTES:—Dr. Zanstra spent the months of July, August and September at the Observatory, during which time he obtained a number of plates of planetary nebulae with the slitless ultraviolet spectroscope.

Mr. A. E. Johns spent two months at the Observatory, working on the problem of the variations in the spectroscopic elements of Boss 3511. He graduated from University of Toronto in 1907; 1907-1910, was a lecturer in Mathematics at Toronto; 1910-1926 on the staff of the West China Union University, Chengtu, his last appointment being Professor of Mathematics, and Dean of the Arts School. He was unable to return to China, owing to the Civil War, and is now teaching Mathematics in Brandon College.

Mr. R. M. Petrie is in his final year at the University of British Columbia. During the past three years he has spent the five summer months at the Observatory, as an assistant.

Mr. P. M. Millman is a Junior in the University of Toronto, in Mathematics and Physics. He is a graduate of the Canadian Academy, Kobe, Japan, in which country he resided for 17 years. During the past summer he was an assistant, at the Observatory. J. A. P.

D.A.O., Victoria, B.C.
January 1, 1928.

RECENT YEARS BRING RECORD COMET DISCOVERIES

By James Stokley*

One of the most remarkable things about the last two years has been the great number of comets that have visited the earth, two of which have become bright enough to be seen with the naked eye. During 1927 ten such visitors came, while in 1926 eleven were discovered. Perhaps this is due to the fact that more careful watch is being kept for them, or perhaps they are more numerous now than they have been in the past.

The most recent of these visitors was the Skjellerup comet, which an Australian amateur, J. F. Skjellerup, picked up on December 3. Though this comet did not come into the northern sky, as expected, it did become bright enough to be seen in the daytime when near the sun—unusually bright for a comet.

As several others of this flock of comets were discovered by amateur astronomers, it is evident that this is one thing that does not require the facilities of a great observatory. However, the Yerkes Observatory, of the University of Chicago, and the Observatory of the University of Heidelberg, Germany, also picked up some of these visitors. But a comet, especially a new one, may turn up at the most unexpected times. Even an old one, a periodic comet that returns again and again, may sometimes be perturbed, and come back some distance away from the place where it was expected to appear. And, again, as has happened in the past, an expected comet may fail to appear at all.

This all indicates that cometary discoveries are largely a matter of good luck.

Great Comet Chaser

One of the first of the great comet chasers was a Frenchman by the name of Messier who lived in the eighteenth century. It is curious that the thing for which his name is to-day best remembered he probably regarded as a nuisance.

Scattered throughout the sky are numerous nebulae. These

*In *Science News-Letter*, Feb. 4, 1928.

appear in a telescope as faint patches of light. When a comet is first discovered, it rarely has a tail, and so it, too, looks like a faint patch of light. So much does it resemble a nebula that the only way of determining its nature is to watch it for a while. The comets are moving among the stars, but not the nebulae. So if a faint patch of light is picked up in the telescope, and it is seen to move, then the astronomer knows that he has a comet.

As the comets may be moving rather slowly, however, it would be rather annoying to an enthusiastic comet hunter to pick up what is supposedly a new comet, and then, after many hours to find that it isn't moving, and so is a nebula after all. Messier, to save this trouble, proceeded to prepare a catalogue of the most conspicuous nebulae, so that he could recognize them instantly. This was the first catalogue and so, even to-day, they are frequently referred to as Messier 33, or Messier 51, according to their number in his list.

Modern Binoculars Better

Messier's telescope had a lens only two and a half inches in diameter, was only two feet long, and only magnified five diameters. A good pair of modern prism binoculars would be far superior to this instrument in every way. But with its aid he discovered thirteen comets.

An anecdote about Messier shows his devotion to his hobby. Another French astronomer, Montaigne, also went in for comet hunting, and there was a keen rivalry between the two men. After Messier had discovered twelve comets, his wife was taken sick and finally died. While attending her, another comet appeared, which was missed by him, but found by Montaigne. After his wife's death, a friend condoled with Messier about his loss. "Alas," exclaimed Messier, "Montaigne has robbed me of my thirteenth comet." Then he realized that he should be mourning his wife, and so added as an afterthought, "Ah, poor woman!"

Later, however, he did find still another comet, so he attained his thirteenth.

One of the comets that has appeared recently bears the name of another famous amateur. The Pons-Winnecke comet, which appeared to the naked eye last summer, was first discovered by Pons,

early in the nineteenth century. Pons was a doorkeeper at the Marseilles Observatory, and encouraged in his hobby by the director.

Radio Saves Comets

Just as important in keeping track of comets as modern telescopes are modern means of communication. Cable, telegraph and radio have saved many a comet from possible loss. One observation of a comet, continued for perhaps an hour or so, will reveal its cometary character. But that will not tell just how it is moving. In order to determine its orbit, three different observations, at different times, are needed. In the old days, a comet might be observed by one astronomer, and then a period of cloudy weather might ensue, during which the comet would be invisible to him. Then, when it cleared again, the comet might have moved out of sight altogether or at least to a very different part of the sky.

Now, this can hardly happen. Take the example of the Skjellerup comet for instance. On December 3, this Australian amateur found the comet. Using a special code for the purpose, he immediately cabled to the Central Astronomical Bureau at Copenhagen, Denmark, which is under the direction of Prof. Elis Strömgren. From Copenhagen the news was cabled over to the United States, as well as to observatories in Europe. It was received at the Harvard College Observatory, the American clearing house, and telegraphed to American and Canadian observatories the day after discovery. This was in code, and looked like this:

SKJELLERUP COMET UXFIBADEUX FIIPDEOTDE BAAMBADEBA DEVYBAKUFI KUIPVYVYFI FIFIAMIPOT.

To the astronomer receiving this mysterious looking wire it conveys the information that Skjellerup has discovered a comet of the third magnitude on December 3.7292 (the time being given in decimal fractions of a day rather than hours, minutes and seconds), and that it was then at 16 hours 12 minutes and 12 seconds right ascension and minus 53 degrees 57 minutes declination. These are the celestial equivalents of latitude and longitude. As soon as an astronomer gets one of these wires he knows where to look for the comet, and so, as the discovery can be broadcast to the whole world in a few hours, some place is almost certain to have clear weather and to observe it.

Three Observations Needed

Then, when the necessary three observations have been made, the exact orbit can be computed, and astronomers can tell how it is moving. At many different observatories orbit computations are made. The first one to be calculated for Skjellerup was done by Dr. H. E. Wood, of the Union Observatory, at Johannesburg, South Africa. In the United States, the chief work of orbit computing is done by graduate students at the University of California, under the direction of Prof. Armin O. Leuschner.

Orbit computing is rather a complicated problem, but an expert at it can sometimes turn out one in a few hours after he has received the three positions. The method was invented by the great German astronomer, Gauss and, curiously enough, was made to order, to keep track of a tiny planet, or asteroid. On January 1, 1801, the Italian astronomer Piazzi found Ceres, the first of these numerous bodies to be discovered. He observed it until February 11, when he was taken sick, and could no longer watch it. Then the little planet came near the sun, and so could not be seen at all. The methods of orbit computation then in use were not able to tell the orbit of the body, so Gauss set to work to invent a new method of computing orbits, with very few positions, and to calculate the orbit of Ceres in time to find it again when it had passed the sun.

Seemingly an impossible task, Gauss actually succeeded in his problem, and he predicted the position so accurately that Ceres was again picked up on December 31, 1801, and has been kept track of ever since. This is essentially the same method now used for comets.

Comets "Airy Nothings"

Impressive as some of the comets become, they are really very small, in mass. In order to allay fears when one comet approached near the earth, an astronomer announced that it could be packed up in a trunk, so rarefied was it. While this is not quite literally true, it gives an idea of the nature of a comet. Though sometimes millions of miles long, the biggest are probably no more massive than a smaller example of the tiny planets. Even when the head, presumably the densest part of a comet, passes in front of a faint star, the star shines through with practically undiminished light. The tail is so imponderable that it is pushed aside by the light from the sun, and therefore always points away from it. When the comet approaches the sun, the tail is behind, when it leaves, the tail precedes.

REVIEW OF PUBLICATIONS

MARS, THE INHABITABLE WORLD

(A Review of an Article in *The American Magazine*)

That ever-popular inquiry, is Mars inhabited? has been almost answered in the affirmative by George W. Gray, writing in *The American Magazine* for February 1928. During an interview with Professor W. H. Pickering, Mr. Gray secures enough encouragement to justify, at least to himself, the selection of a title to his article "Life on Mars is Almost Certain".

It would seem that the English language is strained many times in an effort to avoid breaking out with the words "Mars is inhabited!" The summary, however, is an intensely interesting account of past efforts and recent discoveries having special bearing on this point, and the whole article is a convincng and stmulating narrative of the achievements of astronomers in solving a baffling problem.

Some people who scorn to believe that life can exist on Mars, or anywhere else except on the earth, are warned that the guess made by Jonathan Swift in 1726 ("Gulliver's Travels") that Mars had two moons, was later confirmed by the discovery of Phobos and Deimos in 1877, one hundred and fifty years later, their size and orbits being remarkably in accord with Swift's strange hazard. That other fiction by George DuMaurier in "The Martians" suggesting that those fanciful people could exert a psychical power on the earth's inhabitants, seems to have some connection with Swift, who was probably given the thought by his affinity on Mars itself. Skeptics must beware, therefore, of rejecting the accumulating proofs that life on Mars is not only a possibility but a probability. The next few years may bring positive proof that where there is vegetation there is also animal life to feed upon it.

Of course the whole question, says the article, could be settled if Mars were not so distant, even at the most favourable oppositions.

The best telescope in existence does not bring Mars nearer than the earth's moon as seen with the naked eye. This brings up the point as to how much or how little the human eye can see of the surface markings of Mars, and to what extent our knowledge has been increased by the use of the camera. Several drawings are shown indicating what the human eye has seen through powerful telescopes, and the famous "canals" in curved lines, and straight lines parallel, persist in drawings made by many independent observers. That these are not canals within the English meaning of the word,—the original description being *canali* or straits uniting supposed seas on Mars,—but strips of vegetation which seem to be related to cloud movements and the distribution of water from the snow-capped poles of Mars, is the modern conception.

It is somewhat surprising to find that evidence as to "signals" from Mars is accepted in a measure, and produced as part of the case for the existence of intelligent inhabitants on that planet. A star "with five points" has been seen more than once, and a circle with a cross inside it has been seen and thought to be a signal. One jocularly suspects that the Martians were humorously presenting the outline of a wedding ring, with a cross inside to indicate to earth dwellers that Martial crosses exist with them as with us.

The most serious and convincing evidence which has been brought forward of late years is that relating to the temperature of the surface of Mars, and the proof offered that the Martian atmosphere is much less rare than has been supposed and of considerble depth. The photographing of Mars with an infra-red colour screen placed before the plate, and also with an ultra-violet screen, at the recent oppositions, proved the existence of this atmosphere to a depth of 120 miles; the planet being 240 miles greater in diameter, apparently, when the ultra-violet screen was used.

The masses of vegetation, thinning out or reaching toward the desert areas of Mars, seem to provide a safe basis for supposing that life exists. The changing hue of these wide expanses,—comprising one-third of the whole surface,—from the sear and brown to lighter green and later to deeper shades, as the season advances, and the melting of the snow caps which so obviously brings about these changing conditions, all these phenomena cannot be ignored, and we

are almost obliged to picture the scene on Mars as the long summer, twice the length of ours, gives the crops or vegetation the sunshine and irrigation needed. It is often suggested that Mars is a desert world, reddish-brown because of the extent of its Saharas, lacking water sufficient to support life as we know it. But, around the south pole, it is suspected that vast swamps exist, where mist and clouds form and cause light rain storms. There must also be water underground, and far from being a world destitute of the means of subsistence it has an area of fertility greater in proportion than our earth can boast. The Martian, if he exists, might justly say that life on our earth would be impossible, because three-fourths of the globe is covered with water.

It may be many years before this most interesting problem is solved, but popular interest in it is indicated by the persistent queries of the general public, and the fact that a magazine with one of the largest circulations in the world believes it worth while to sum up in several pages of word and picture the story of life on Mars in so far as Astronomy is able to demonstrate that possibility.

F.T.S.

NOTES AND QUERIES

Communications are invited, especially from amateurs. The Editor will try to secure answers to queries.

Information Regarding Cool Summers

From Prof. A. J. Henry of the U.S. Weather Bureau, who has investigated the summer temperatures in the United States for the last hundred years, some interesting information is obtained.

At New Haven, Conn., and New Bedford, Mass., the meteorological records reach back over a century. At both places the summer of 1816 was the coolest, but since then there have been at New Haven 29 summers cooler than that of 1927 and at New Bedford there have been 31.

In the western states conditions were quite different. At Portland, Ore., in the last fifty years, the summer of 1926 was the warmest and that of 1927 was next to it. In the records at San Francisco, the summer of 1927 ranks third, only those of 1888 and 1925 having been hotter.

At Lynchburg, Va., Memphis, Tenn., and Cincinnati, Ohio, the summer of 1927 was the coldest in fifty years. At New York, Philadelphia, Chicago, St. Louis and Indianapolis the last summer was second coldest and at Washington it was third coldest.

Prof. Henry also suggests that the temperature of 1816 may have been exaggerated as there is no evidence that the summer temperatures generally throughout the United States were unduly low.

An Amateur's Downfall (Contributed)

As a general rule, I am reduced to seriousness when gazing at the heavens, but the other evening by way of recreation I became somewhat flippant, and lapsed into limerick; the only excuse for which is that versification of this kind aids the amateur in mastering the pronunciation of the names of the various constellations:

"HIGH DOINGS"

Is it true, as they say, that the Sky's getting gay,
That two stars are supporting Altair?
That at fashion's behest, as we might have guessed,
Berenice is bobbing her hair?

Of this we are dubious, but Arcturus is furious
At a sight he maintains is quite clear—
And there's no use in denyin' that spalpeen O'Ryan
Is flirting with Cassie O'Peer.

MEETINGS OF THE SOCIETY

AT TORONTO

The regular Meeting of the Royal Astronomical Society of Canada was held in the Physics Building of the University on November 15, at 8 p.m. The President, Mr. A. F. Hunter, in the chair.

The following were elected Members of the Society:—

F. J. Ferris, 29 Charles St. W., Toronto
Edwin B. McBride, 54 Moore Ave., Toronto
L. H. R. Wismer, 118 Moore Ave., Toronto
Prof. C. C. Crump, Perkins Observatory, Delaware, Ohio.

The chairman called on Prof. C. A. Chant, who continued his illustrated lecture entitled "An Introduction to Astronomy." Part 1 had been given at the meeting two weeks ago; to-night the 2nd and 3rd parts were given. This lecture is printed in a booklet containing 60 pages.

Prof. Chant has treated the subject in his usual masterly way. His intention in writing the booklet was that it should be a guide to lecturers in the elementary features and principles of Astronomy. The slides accompanying the lecture are excellent.

The meeting was well attended.

The regular fortnightly meeting was held in the Physics Building of the University of Toronto on the evening of November 29, 1927. The President of the Society, Mr. A. F. Hunter, occupied the chair.

Mr. Hunter reported that the General Council held a Meeting on the 25th inst., at which a large number of names were placed on the ballot paper for next year's Council.

The chairman announced that at the next meeting a new Board will have to be appointed to take care of the programme, and also the expenditure of money in connection with Toronto Meetings.

Prof. A. P. Coleman, Emeritus Professor of Geology in the University of Toronto, was then introduced to the audience, to give his lecture as announced, "Ice Ages, and their Duration."

In his opening remarks he stated that astronomy and geology were sister sciences. Astronomy, of course, was the elder sister, jocularly, he thought astronomers were inclined to overlook the third planet, and geologists naturally ought to resent this. Again the astronomers when asked as to the age of the Solar System talked very vaguely and geologists were inclined to imitate astronomers in this regard. Prof. Coleman stated that geologists are thinking in terms of billions where formerly millions were used.

One of the rather interesting statements made was that the earth's present climatic condition was not normal. There have been periods of fluctuation of which the ice ages are an evidence. Further, that the earth was now in the warming-up period.

Prof. Coleman's lecture was one of the most interesting given this season.

The President thanked the lecturer for his valuable address. Mr. J. R. Collins also added his appreciation.

The regular meeting was held in the Physics Building, December 13, 8 p.m. Mr. A. F. Hunter in the chair.

The chairman referred to the recent appointment of a Board to have the oversight of the Toronto Meetings. He stated that their term had expired, and called for nominations for a new Board for the ensuing year.

The following were duly elected:—Mr. R. A. Gray, Mr. J. R. Collins, Mr. A. R. Hassard and Mr. E. J. A. Kennedy. It was also provided that this Board would be augmented by the addition of the Toronto members nominated for, but not elected to, the General Council at the forthcoming Annual Meeting in January.

The following were elected members:—

Mr. E. H. Bickford, 136 King St., Kingston, Ont.
Mr. Ernest W. Flower, Surrey Place, Toronto.
Mr. W. M. Kenny, 1 Dodge Rd., Birchcliffe, Toronto.
Mr. Herbert Griffiths, 645 St. Clair Ave. E., Toronto.

The chairman then introduced Mr. P. M. Millman, who delivered an exceedingly interesting address on the subject "A Summer at the Astrophysical Observatory, Victoria, B.C." Slides of the great 72-inch reflector were shown. Particular mention was made of the work of the astronomers Dr. J. S. Plaskett, and Mr. W. E. Harper. Mr. Harper's special study has been in spectroscopic binaries. Of some 300 orbits which have been computed, 52 are credited to him, the largest number to any astronomer in the world.

Professor Chant followed with the concluding part of his series on "An Introduction to Astronomy". Interesting as the other three were, this was unusually so. This series, if made use of in the way Dr. Chant intended, will do a great deal to popularize Astronomy.

E. J. A. KENNEDY, *Recorder.*

VICTORIA, B.C.

1927, October 10.—This was a joint meeting of the British Columbia Historical Society, British Columbia Natural History Society and the Victoria Centre of the Royal Astronomical Society of Canada.

The following were elected members:—

Dr. Carlyle S. Beals, Dominion Astrophysical Observatory.
Norman A. Waite, Canmore, Alberta.

The speaker of the evening was Chief William Shelton, Snohomish

Tribe, Tulalip, Washington, who addressed the meeting on, The Indian Myths and Legends of the Pacific Coast. Chief Shelton, accompanied by Mrs. Shelton, appeared in costume. His address centered around the Totem Pole which he stated was the basis of all Indian education on the Pacific Coast. There were two kinds of poles, the Story Pole and the Totem Pole. Associated with each animal figure on the Story Pole was a legend, at the conclusion of which was some vitally important moral lesson for the young Indian. In this respect the legends resemble the Fables of Aesop.

Chief Shelton illustrated his address by telling a number of stories represented by the animals on the splendid 80-foot Story Pole which he carved for the city of Everett, Wash. There are twenty-eight figures on this pole, illustrating sixteen legends.

A number of Indian articles, such as a quiver full of arrows, peace-pipe, bag of red paint, etc., were exhibited and described.

At the conclusion of the address, a number of questions were asked Chief and Mrs. Shelton, to whom a vote of thanks was returned.

November 10th.—The following were elected members:—

A. G. Blaylock, Esq., Trail, B.C.

John Campbell Scott, Esq., Box 1223, Seattle, Wash.

The address of the evening was given by W. E. Harper, a Past-President of the Centre, upon the subject "Exploring Space".

The speaker began by stating that an arc of the earth's surface had been carefully measured and through astronomical observations the whole circumference, and hence the diameter of 7927 miles was obtained.

To obtain the distances of bodies like the moon, sun and stars, a method similar to that used by the surveyor in mountainous country is used. Here the surveyor measures accurately a base line a mile or so in length and by taking the directions of various peaks from both ends of his base, he is enabled to deduce their distances. Astronomers separated by a few thousand miles on the earth, and making that distance serve as their base, can by observing the moon's position at any instant determine its distance as approximately 238,000 miles.

An indirect method is better to get the sun's distance. On rare occasions Venus comes directly between us and the sun and the difference in its apparent path across the sun's disc as seen from the north and south hemispheres can be used to obtain its distance. A better method comes through determining the distance of the little asteroid, Eros, at favourable oppositions. Its distance then can be related to the sun's. The latter distance is approximately 93,000,000 miles.

The diameter of the earth's orbit about the sun, or 186,000,000 miles, is the base used to obtain the distances of the stars which are, of course, much greater. Photographs of a region of the sky, taken six months apart under identical conditions, will enable us to deduce the distances of the stars in the region relative to our base. This method will serve for stars whose

distances are not greater than ten million times the sun's distances. Beyond that the method breaks down.

Among stars whose distances are thus determined, a great range of real brightness was found to exist. If they could all be placed at the same distance some would outshine others 10,000 to 1. Thus originated the terms "giants" and "dwarfs". Differences were found to exist in the spectra of giants and dwarfs so that a relationship could be established connecting such differences with the real brightnesses of the stars. The examination of the spectra of unknown stars then served to show their real luminosities from which their distances could be deduced.

The lecturer closed by giving a rapid bird's eye view of the stellar universe. The 2000 million stars occupy space somewhat like a flattened discoid. The Milky Way represents the long diameter of this universe, the milkiness being due to the blended light from millions of faint distant stars. The solar system lies in the central plane of the Milky Way though off to one side of its centre. In the other direction lie the globular star clusters, the most distant being 230,000 light years. Certain spiral nebulae are believed to be a million light years distant, such knowledge being deduced from the light variations of faint objects within them.

The lecture was illustrated throughout with lantern slides.

During the discussion, following the lecture, Mr. T. L. Gillespie, a member of the local centre resident in Kelowna, B.C., spoke upon the great pleasure of making a telescopic study of the heavens, and lamented the fact that the Government did not help the amateurs of our Society obtain small and comparatively inexpensive refractors.

December 6th.—The annual general meeting of the Victoria Centre was held in the Girls' Central School on December 6th, at 8.00 p.m. The large auditorium was filled to its capacity the estimated attendance being 350.

The following were elected members:—

W. Gage, Esq., B.A., Victoria College, Victoria.
Geo. H. Keefer, Esq., Union Bank Bldg., Victoria.
W. H. Smith, Esq., 1029 Princess Ave., Victoria.
H. Haines, Esq., Vernon, B.C.

Ten interesting and instructive reels of astronomical motion pictures were then shown, the titles being: Mysteries of Space; Comets; Worlds in the Making; The Birth of the World; All Aboard for the Moon; The Earth and the Moon; Eclipses of the Sun and Moon.

During the intervals between the reels, questions were answered and explanations made by the Vice-President J. A. Pearce.

Following the pictures the business part of the meeting was held.

The Minutes of the annual general meeting of 1926 were read and confirmed. The Secretary-Treasurer presented his reports, which showed a substantial increase in the membership of the Centre during the year.

Messrs. W. H. Christie and S. N. Hill, scrutineers, then reported the results of the ballots for the 1928 officers, as follows:—

Honorary President—Daniel Buchanan, M.A., Ph.D.
President—J. A. Pearce, M.A.
First Vice-President—H. H. Plaskett, B.A.
Second Vice-President—R. G. Miller.
Secretary-Treasurer—C. S. Beals, M.A., Ph.D.
Council—J. P. Hibben; Rev. J. Goodfellow, M.A.; A. W. Giles; P. S. Langton; G. A. Bucklin, and the Past-Presidents, J. S. Plaskett, D.Sc., F.R.S.; F. N. Denison; W. S. Drewry, C. E.; J. E. Umbach, C.E.; W. E. Harper, M.A.; James Duff, M.A. and P. H. Elliott, M.Sc.

R. G. MILLER, *Secretary-Treasurer.*

CORRECTION

On page 28 it is stated that Mr. Frank S. Hogg obtained the B.A. degree at the University of Toronto in 1925. This should be 1926.

C. A. C.

The Royal Astronomical Society of Canada

OFFICERS FOR 1927

Honorary President—Hon. G. H. Ferguson, K.C., B.A., LL.D., Minister of Education for Ontario
President—A. F. Hunter, M.A., Toronto
First Vice-President—H. R. Kingston, M.A., Ph.D., London
Second Vice-President—R. K. Young, Ph.D.
General Secretary—Lachlan Gilchrist, M.A., Ph.D., Toronto
General Treasurer—H. W. Barker, Toronto
Recorder—E. J. A. Kennedy
Librarian—Prof. C. A. Chant
Curator—Robert S. Duncan
Council—Mgr. C. P. Choquette, M.A., Lic.Scs., Montreal; J. B. Fraser, M.D., Toronto; R. A. Gray, B.A., Toronto; A. R. Hassard, B.C.L., Toronto; J. H. Horning, M.A., Toronto; Dr. Ralph DeLury, Ottawa; Prof. John Mathe-son, M.A., Kingston; Prof. A. S. Eve, F.R.S., Montreal; John Satterly, M.A., D.Sc., Toronto; Dr. D. M. Wunder, Toronto; and Past Presidents: John A. Paterson, M.A., K.C.; Sir Frederic Stupart, F.R.S.C.; A. T. DeLury, M.A.; Louis B. Stewart, D.T.S.; Allan F. Miller; J. S. Plaskett, B.A., D.Sc.; J. R. Collins; W. E. W. Jackson, M.A.; R. Meldrum Stewart, M.A.; and the Presiding Officer of each Centre as follows: H. M. Ami, D.Sc., Ottawa; Col. W. E. Lyman, Montreal; Mrs. E. L. Taylor, Winnipeg; Prof. P. H. Elliot, Victoria, B.C.; H. R. Kingston, M.A., Ph.D., London.

OTTAWA CENTRE

President—Dr. H. M. Ami
Vice-President—C. C. Smith, B.A., D.L.S.
Secretary—A. H. Hawkins, D.L.S., Topographical Surveys Dept., Ottawa.
Treasurer—J. F. Fredette, D.L.S.
Council—W. W. Nichol, M.A.; J. S. Lane, B.A.; Dr. T. L. Tanton; and Past Presidents: R. M. Stewart, M.A.; J. J. McArthur, D.L.S.; R. E. DeLury, M.A., Ph.D.; R. J. McDiarmid, M.Sc., Ph.D.; and C. R. Coutlee, C.E.

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President—Col. W. E. Lyman.
1st Vice-President—Rev. W. T. B. Crombie, M.A.
2nd Vice-President—H. E. S. Asbury
Treasurer—Prof. A. J. Kelly
Secretary—Miss A. Vibert Douglas, Ph.D., McGill University, Montreal
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Vice-President—Mrs. W. E. Saunders
Secretary-Treasurer—E. T. White, B.A., D.Paed., 36 Marley Place, London, Ont.
Council—Rev. R. J. Bowen, F.R.G.S.; T. C. Benson; Mrs. J. C. Middle-ton; W. A. McKenzie; E. H. McKone, B.A., D.Paed.

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Treasurer—Mr. H. B. Allan
Secretary—Mrs. S. C. Norris, 569 Sherburn St.
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VICTORIA CENTRE

Honorary President—F. Napier Denison.
President—Prof. P. H. Elliot, M.Sc.
Vice-President—J. A. Pearce, M.A.
Secretary-Treasurer—R. G. Miller, 2050 Oak Bay Rd., Victoria, B.C.
Council—E. E. Blackwood, J. P. Hibben, H. H. Plaskett; Rev S. Tellow, and Past Presidents: W. S. Drewry, J. E. Umbach, W. E. [illegible], M.A., J. Duff, M.A., and J. S. Plaskett, F.R.S.